SEDIMENT SAMPLING & ANALYSIS PLAN FOR THE PORT OF ASTORIA EAST BOAT BASIN NORTH BREAKWATER REPAIR PHASE II

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1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: The project is located at the Port of Astoria, East Mooring Basin, Columbia River, Clatsop County, Astoria, Oregon. Repair/replacement is to be done on the east boat basin north breakwater structure. Dredging is to take place at the base of the east-end of the structure, the next 200' to 1000'adjoining the Phase I construction (east most 400' of the structure). The sampling will take place around the balance of the structure not previously sampled in phase I of the construction. Purposed disposal of the dredge material is to be inwater, if suitable. Sediment sampling will be done on both sides of the balance of the structure that has not been repaired/replaced. The vibra core samples will be submitted for chemical and physical analysis. Surface samples will be taken on the north side of the breakwater structure in areas where sediment depth is not sufficient to provide enough volume of sample with the vibra core sampler. The surface samples will be submitted for physical analysis only, unless they consist of greater than 20% fines. If greater than 20% fines, samples will be submitted for chemical analyses also. Enough sediment will be collected to run bioassays on the samples if screening levels (SL) are exceeded in the chemical analyses. Chemical analyses will be accelerated to insure that bioassay sample "hold times" are not exceeded if it is determined they are necessary to determine disposal method.

1.2 Site History: In January 1994 permit maintenance dredging took place within the breakwater area to maintain adequate depth for commercial fishing vessels. Prior to dredging sediment quality samples were taken and submitted for analysis and the material found suitable for inwater disposal. Sediment samples were collected on April 27, 1998 and June 30, 1998 for the phase I construction of the breakwater. The material was not found to be suitable for inwater disposal and was disposed of upland at a permitted disposal site (Hillsboro, OR landfill)

1.3 Previous Sediment Sampling: Four sediment samples were taken December 7, 1993 at the Port of Astoria East Mooring Basin (PAEMB) and tested for metals, pesticides, polychlorinated biphenyls (PCBs) and polynuclear aromatic hydrocarbons (PAHs). All the samples showed low levels for 2 or more PAHS. All the samples contained some of the butyltin (by bulk analysis) compounds. All samples contained metals at low levels except for the number 1 sample which had several metals (As, Pb, Cu) at higher levels. This sample was taken outside of the area to be dredged, however. All samples taken from the area to be dredged were well below the screening levels established in the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF-LCRMA) manual.

On April 27,1998 five core samples and 3 surface grab samples were taken at the East End of the breakwater structure. All samples were submitted for physical and chemical analyses. DDT was found to be in excess of the 6.9 ug/kg screening level (SL) of the DMEF-LCRMA manual. Both the upper 4' and lower 4' analyses for DDT exceeded the SL. The analysis for the upper 4' core sample showed DDT was 9.7 ug/kg. The lower 4' core sample showed 7.0 ug/kg DDT in the sample. As a result of these analyses additional sediment was collected on June 30, 1998 and submitted for biological analyses. During sampling an oil sheen was evident in one sample and was submitted for semi-volatile (PAH) analyses. The results of the semi-volatile analysis indicated PAHs in excess of the SL. The bioassays failed as a result of sediment larval normalization combined mortality and abnormality exceeding 30% of the reference and showed statistical significant response relative to the reference sediment. The dredge material was disposed of upland at a permitted facility.

2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the (DMEF-LCRMA) manual.

- Collect, handle and analyze representative sediment, surface and core samples of the proposed dredging prism in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Only physical and chemical characterization will be conducted initially. If DMEF-LCRMA guideline SLs are exceeded bioassays will be run on all samples exceeding SLs.

3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: The East Boat Basin area has been ranked "moderate/heterogeneous" under DMEF-LCRMA guidelines, based on data received form past sampling.

3.2 Sampling and Analysis Requirements: The guidelines for moderate contamination with a heterogeneous nature indicate one sample for every 20,000 cys of material dredged. Five primary core samples and 1 grab sample are scheduled to be collected. These will be adequate sampling for the estimated 80,000 cys of material to be dredged in phase II as well as any future phases necessary to complete construction of the entire breakwater structure.
The material to be dredged from the perimeter of the breakwater structure will be sampled using a vibra core sampling devise and a power grab, surface sampler. A vibra coring system collects a continuous profile of sediments below the mudline. A power grab sampler is a clamshell, surface sampler. All samples will be subjected to physical analyses. All vibra core samples will be subjected to both physical and chemical analyses. In addition to the 5 primary cores and 1 surface sample, 1 reference and 1 Quality Control (QC) sample for chemical analyses will be conducted. The 5 primary core samples will be composites of 1 or more core samples. The QC blind replicate sample will be submitted for chemical analysis only. A separate QA lab will not be utilized.

4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Sampling Locations and Numbering: Figure 1 shows the project area and sample locations. Sampling sites are located for the best characterization of the material within the dredging prism as possible. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Sample identification shall follow the following convention:

A-XX-YY

Where, "A" denotes samples collected from Astoria, "XX" denotes the type of sampling device such as "VC" = vibra corer, "PG" = Power grab; "YY" denotes the numeric sample sequence number and will consist of two digits for all samples, except composites (i.e. 01, 05, 15, etc.). The QC replicate will have a letter only designation following the "site location" and the "sampling device" (i.e. A-VC-A). The sample that is duplicated will be noted in the field logbook. Composite samples will have a combined number in the "YY" designation (i.e. sample 02 & 03 = 023, etc.).

4.2 Field Sampling Schedule: Sampling is planned for May 5, 1999.

4.3 Field Notes: Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Names of the person(s) collecting and logging in the samples.
- Weather conditions.

- Depth of each station sampled as measured from the water surface. This will be accomplished using a leadline or corrected depth recorder.
- Date and time of collection of each sediment sample.
- The sample station number and individual designation numbers assigned for each individual sample.
- Descriptions of sediment or core sections.
- For cores the length of core and the penetration depth of the sampling device.
- Any deviation from the approved sampling plan.

4.4 Positioning: Sampling locations will be recorded in the field. Horizontal coordinates will be referenced to the Oregon Coordinate System for proper North or South Zones NAD 27 (North American Datum 1927). Horizontal coordinates will be identified as latitude and longitude to the nearest 0.1 second.

4.5 Decontamination: All sampling devices and utensils will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox soap
- Rinse with distilled water
- Rinse with 10% nitric acid solution
- Rinse with distilled water

Utensils used to collect physical samples only or sampling devices such as the power grab sampler will be washed down before each sampling event. However, they will not require the cleaning procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All hand work for chemical analyses will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

4.6 Core Logging: Each discrete core section will be inspected and described. For each core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from Columbia River Datum.
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratification and lenses
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7 Field Compositing: Up to eight core samples will be collected, some of the core samples will be composited prior to submission to the laboratory. Cores to be composited will be selected in the field, based on sediment recovery and sediment similarity.
Numbering of the composites will contain the same designations of “site location” and “sampling device” as the other samples (as mentioned above, sec.4.1). Composite samples will have a combined number in the “YY” designation (i.e. sample 02 & 03 = 023, etc.).

4.8 Field Replicates: Blind field replicates will be prepared and submitted along with the rest of the samples to the laboratory. This represents about 10% of the total samples collected. The QC replicate will have a letter only designation following the "site location" and the "sampling device" (i.e. A-VC-A). Replicate sample locations shall be documented in the field logbook.

4.9 Sample Transport and Chain-of-Custody Procedures: After sample containers have been filled they will be packed in ice or "blue ice" in coolers. Chain-of-custody procedures will commence in the field and will track delivery of the samples. Sample holding times and storage requirements are presented in Table 1. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and office name and address) to enable positive identification.
- Chain-of-custody forms will be enclosed in a plastic bag and placed inside cooler.

Upon transfer of sample possession to the laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers will be inspected and the receiver will record the condition of the samples.

Table 1, Sample Volume and Storage

Sample Type	Holding Time	Sample Size (a)	Temperature (b)	Container
Particle Size	6 Months	200 g	4ºC	1-1 Quart Plastic Bag
PAHs, Phenols, Phthalates, Misc. Extractables, Chlorinated Organic Compounds	14 Days	125 g	4ºC	1-1 Liter Glass (combined)
Total Volatile Solids	14 Days	125 g	4ºC	
Total Organic Carbon	14 Days	125 g	4ºC	
Mercury	28 Days	5g	4ºC	
Metals (except Mercury)	6 Months	50 g	4ºC	
Pesticides and PCBs	14 Days	10 g	4ºC	
Butyltin (pore water)	14 Days	4 liters(for extraction)	4ºC	4-1 Liter Glass
Bioassays	14 Days	4 liters	4ºC	

a. Required sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retest.
b. During transport to the lab, samples will be stored on blue ice.
c. A minimum 250-ml container is filled and frozen to run any or all of the analyses indicated.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the DMEF-LCRMA. The samples will be analyzed for all the parameters listed in sections 5.1.3 and 5.1.4 as requested on the chain-of-custody record. Private contract analytical chemical laboratories will conduct all physical and chemical analyses.

5.1.1 Chain-of-Custody: A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection: Detection limits of all chemicals of concern must be below screening levels. All reasonable means, including additional cleanup steps and method modifications, will be used to bring all limits-of-detection below the screening levels. In addition, an aliquot of each sediment sample for analysis will be archived and preserved at -18 C for additional analysis if necessary. Sediments or extracts will be kept under proper storage conditions until the chemistry data is deemed acceptable.

5.1.3 Sediment Chemistry: Private analytical laboratories will conduct all chemical analyses. Chemical analyses will include: metals (6010/7000 or 6020 series), total organic carbon (TOC) method 9060, polynuclear aromatic hydrocarbons (PAHs), phenols, phthalates, chlorinated organic compounds, misc. extractables by 8270 SIM method or other low level detection method, pesticides/PCBs by 8081 and Butyltin (TBT) compounds, by pore water method.

5.1.4 Sediment Conventionals: The private analytical laboratories will analyze physical parameters. Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. NO. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will use for particle sizes finer than the 230 mesh. Water content will be determined using ASTM D 2216. Sediment classification designation will be made in accordance with U.S. Soil Classification System, ASTM D 2487.

5.1.5 Holding Times: To the maximum extent practicable all chemical results will be provided within 7-14 days of receipt. All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 1 and analyzed within the holding times shown in the table.

5.1.6 Quality Assurance/Quality Control: The chemistry QA/QC procedures found in Table 2 will be followed.

5.2 Laboratory Written Report: The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

Table 2, Minimum Laboratory QA/QC

Analytical Type	Method Blank[2]	Duplicate[2]	RM[2,4]	Matrix Spikes[2]	Surrogates[7]
Semivolatiles[1]	X	X[3]	X[5]	X	X
Pesticides/PCBs[1]	X	X[3]	X[5]	X	X
Metals	X	X	X[6]	X	
Total Organic Carbon	X	X	X[6]		
Total Solids		X			
Total Volatile Solids		X			
Particle Size		X			

1. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.
2. Frequency of Analysis = one per batch
3. Matrix spike duplicate will be run
4. Reference Material
5. Canadian standard SRM-1
6. NIST certified reference material 2704
7. Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

6.0 BIOLOGICAL TESTING

6.1 Bioassay Laboratory Protocols. Bioassay testing requires that test sediments be matched and run with appropriate approved reference sediment to factor out sediment grain-size effects on bioassay organisms.

Selection of appropriate reference sediment will be made as stipulated in the DMEF-LCRMA and approved by EPA and DEQ. The reference site sample will be collected from the potential confined area disposal (CAD) site. This is the area that potentially could be used for CAD, if necessary and is approved by EPA and DEQ.

6.2 General Biological Testing Procedures.

- Physical and chemical analyses will be conducted prior to the start of any biological testing. Biological testing will be initiated if screening levels are exceeded in the chemical analyses. The same convention will be used to number, log, collect and decontaminate while collecting samples, as described earlier in the sampling and analysis plan.

- Five laboratory replicates of test sediments, reference sediments and negative controls will be run for each bioassay.
- Cadmium chloride will be used as a reference toxicant for all three bioassays, using standardized concentrations specified by DMEF-LCRMA.
- For the *Neanthes* and amphipod bioassays, sacrificial beakers will be used to determine interstitial salinity, ammonia and sulfides for all test and reference sediments at the beginning and end of the test

period. Overlying ammonia and sulfides will be determined at test initiation and termination for the larval test.

- Water quality monitoring will be conducted, consisting of daily measurements of salinity, temperature, pH and dissolved oxygen for the amphipod and sediment larval bioassays and measurements every three days for the *Neanthes* test. Monitoring will be conducted for all test and reference sediments and negative controls (including seawater controls). Parameter measurements must be within the limits specified for each bioassay. Measurements for each treatment will be made on a separate chemistry beaker set up identically to the other replicates within the treatment group, including the addition of test organisms.

6.3 Bioassay-specific Procedures.

6.3.1 Amphipod Bioassay. Data to be reported for this bioassay include survival, daily emergence and the number of amphipods failing to rebury at the end of the test. The control sediment has a performance standard of 10 percent mortality. The reference sediment has a performance standard of 20 percent mortality greater than control. The test involves exposing amphipods (species - *Ampelisca abdita*) to test sediment for ten (10) days and counting the surviving animals at the end of the exposure period.

6.3.2 Sediment Larval Bioassay. The test organism will be selected in consultation with the testing lab and dredge material management office (DMMO). Initial counts will be made for a minimum of five 10-ml aliquots. The test will be run until the appropriate stage of development is achieved in a sacrificial seawater control (PSDDA MPR-Phase II, pp. 5-10). Aeration will be conducted throughout the test to minimize effects from hydrogen sulfide and ammonia. At the end of the test, larvae from each test sediment exposure will be examined to quantify abnormality and mortality. Final counts for seawater control, reference sediment and test sediment will be made on 10-ml aliquots. The test monitors larval development of a suitable mollusk (species – *Mytilus galloprovincialis*) or echinoderm species in the presence of test sediment. The test is run until the appropriate stage of development is achieved in a sacrificial sea water control. At the end of the test, larva from each test sediment exposure is examined to quantify abnormality and mortality.

The seawater control has a performance standard of 30 percent combined mortality and abnormality. The reference sediment has a performance standard of 35 percent combined mortality and abnormality normalized to seawater control.

6.3.3 Neanthes Growth Test. *Neanthes arenaceodentata* takes 2 – 3 weeks to culture and deliver, test organisms will be obtained early enough to begin testing with a minimum delay as possible after notification that tests will be conducted. The test utilizes a polychaete (species - *Neanthes arenaceodentata*), in a 20-day growth test. The growth rate of organisms exposed to test sediments is compared to the average individual growth rate of organisms exposed to reference sediment.

The control sediment has a performance standard of 10 percent mortality. The reference sediment has performance standards of 20 percent mortality and 80 percent of the control growth rate.

6.4 Interpretation. Test interpretations consist of endpoint comparisons to control and reference on an absolute percentage basis as well as statistical comparison to reference. Test interpretation will follow the guidelines established in the PSDDA Management Report-Phase II (page 5-17) for the amphipods and sediment larval bioassays, and the minutes of the dredging year 1991 annual review meeting for the *Neanthes* bioassay, as modified by subsequent annual review proceedings and workshops.

6.5 Bioassay Retest. Any bioassay retests must be fully coordinated with, and approved by, the DMMO.

6.6 Laboratory Written Report. The biological laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory bioassay analyses and QA/QC results.
- All protocols used during analyses and any deviation from the approved sampling plan.
- Chain of custody procedures, including explanation of any deviation from the identified protocols.
- Location and availability of data, laboratory notebooks and chain-of-custody forms.

As appropriate, this sampling plan may be referenced in describing protocols.

7.0 REPORTING

7.1 QA Report: The laboratory QA/QC reports will be incorporated by reference. This report will identify any laboratory activities that deviated from the approved protocols and will make a statement regarding the overall validity of the data collected.

7.2 Sediment Evaluation Report: A written discussion of findings shall be prepared documenting the physical, chemical and biological (if necessary) character of potential material to be dredged. The physical and chemical reports will be included as reference; individual copies will be furnished as requested. As a minimum, the following will be included in the

- Previous sampling and analyses.
- Locations where the sediment samples were collected.
- A plan view of the project showing the actual sampling location.
- Description of sampling.
- Chemical testing data, with comparisons to screening levels guidelines.
- Biological testing data and evaluation based on the DMEF-LCRMA manual.

APPENDIX A

PARAMETERS AND METHODS

1. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.

2. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Estuary Program, March 1986.

3. Recommended Methods for Measuring TOC in Sediments, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.

4. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.

5. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 3050, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.

6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

8. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 7471, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.

9. Sonication Extraction of Sample Solids - Method 3550 (Modified), SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986. Method is modified to add matrix spikes before the dehydration step rather than after the dehydration step.

10. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

11. Purge and Trap Extraction and GCMS Analysis - Method 8260, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

12. Soxhlet Extraction and Method 8081, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

13. Total PCBs BT value in mg/kg oc.

QA2 DATA REQUIREMENTS

CHEMICAL VARIABLES

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

A cover letter referencing or describing the procedure used and discussing any analytical problems

Reconstructed ion chromatograms for GC/MS analyses for each sample

Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra

GC/ECD and/or GC/flame ionization detection chromatograms for each sample

Raw data quantification reports for each sample

A calibration data summary reporting calibration range used [and decafluorotriphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]

Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit

Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)

Quantification of all analytes in method blanks (ng/sample)

Method blanks associated with each sample

Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)

Data qualification codes and their definitions.

METALS

For metals, the data report package for analyses of each sample should include the following:

Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager

Any data qualifications and explanation for any variance from the analytical protocols

Results for all of the QA/QC checks initiated by the laboratory

Tabulation of instrument and method detection limits.

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of

July 1999

Astoria – East Boat Basin Breakwater Sediment Evaluation, Phase II

(May 4, 1999 Sampling Event)

Abstract

The Clean Water Act (CWA) of 1977, as amended regulates dredging activities and requires sediment quality evaluation, including testing, prior to dredging. Guidelines to implement 40 CFR Part 230-Section 404(b)(1) regulations of the CWA, the national (The Inland Testing Manual) (ITM) and the regional (Dredge Material Evaluation Framework for The Lower Columbia River Management Area Dredge Material Evaluation Framework) (DMEF) manuals have adopted a tiered testing approach for the evaluation of dredge material. The Tier IIa (physical testing) and Tier IIb (chemical testing) have been completed for this evaluation. The screening levels (SL) used are those listed in the regional manual.

The Corps of Engineers, Portland District personnel, collected 6 vibra-core samples and 5 surface grab samples on May 4, 1999. The samples were classified as, silty sand to silt. The mean grain size of all samples was 0.70mm. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), phenols and phthalates. A composite from four sampling stations (A-VC-03 through A-VC-06, located inside the boat basin, was analyzed for organotin (interstitial water method). All analyses except the organotin were below SLs. The organotin results exceeded the SL of 0.15 ug/L with a result of 0.748 ug/L. As a result, follow-up TBT analyses were run on all sediment samples collected. These follow-up analyses isolated the TBT, above the SL, to be outside the Phase II construction area (A-VC-03 sample). This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which did not exceed the SL and are located outside the Phase II construction area.

The Tier IIa (physical) and the Tier IIb (chemical) analyses run on the proposed dredge material from Phase II of this project are well below SLs and the dredge material is determined to be suitable for unconfined in-water disposal without further testing.

Introduction

The purpose of this report is to characterize the sediment of the Astoria East Boat Basin, based on the sampling events described. Reference will be made to the project Sampling and Analysis Plan (SAP) attached to this report and listed as a reference. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below.

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.

- Collect, handle and analyze representative sediment, surface and core samples, of the purposed dredging prism, and the newly exposed surface, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Only physical and chemical characterization will be conducted, unless sediment analysis indicates the necessity for further testing.

Historical Data

The Corps of Engineers, Portland District personnel took 5 core samples and 3 surface grab samples on April 27, 1998 within the Phase I dredge prism. The core samples taken were classified as, fine to very fine-grained sandy silt with color bands of dark gray to light gray and contained small amounts of organic material. The 2 longest cores (A-VC-02, 03) were divided into 2 (lower & upper) composite samples each. The other cores and surface samples were treated as individual samples. All samples were submitted to Sound Analytical Services, Inc. laboratory for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). Total DDT exceeded the SL (6.9 ug/kg) on one core, both top "A" and bottom "B" samples. The "A" sample is a composite from the surface to 48 inches in depth, with DDT detected at 9.69 ug/kg. The "B" sample represents the lower depth, from 48 inches down to the core depth of 130 inches, with DDT detection of 7.0 ug/kg. As a result of the DDT exceedance Tier III bioassay were collected on June 30, 1998. Three samples by gravity core and 1 box core sample were taken near the breakwater structure where DDT was detected in excess of the SL. These samples were submitted for bioassay analysis as well as ammonia, sulfide, TOC, total DDT, and physical analyses. DDT was not detected above the screening level in any of the samples collected. One sample (A-GC-02) was also submitted for PAHs when a petroleum sheen and odor were detected in the field sample. PAHs were detected in excess of the screening levels for some PAHs. A box core sample was taken further from the wall as a reference site for the bioassay analysis. The bioassay analysis indicated the material was not suitable for open water disposal. The dredge material was disposed of at an upland disposal facility.

Current Sampling Event Methods and Discussion

On May 4, 1999 six vibra-core samples and 5 surface grab samples were collected. The samples were classified as silt to silty sand. The mean grain size of the samples was 0.70mm. All samples were submitted for physical and chemical analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), phenols and phthalates. A composite from four sampling stations (A-VC-03 through A-VC-06, located inside the boat basin, was analyzed for organotin (interstitial water method). All analyses except the organotin were below SLs. The organotin results exceeded the SL of 0.15 ug/L with a result of 0.748 ug/L. As a result, follow-up TBT analyses were run on all sediment samples collected. These follow-up analyses isolated the TBT, above the SL, to be outside the Phase II construction area (A-VC-03 sample). This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which, did not exceed the SL and are located outside the Phase II construction area.

The Tier IIa (physical) and the Tier IIb (chemical) analyses run on the proposed dredge material from Phase II of this project are well below SLs and the dredge material is acceptable for unconfined in-water disposal without further testing.

Sampling and analysis were performed using proper quality control measures. Proper chain of custody, preservation (4°C.) and cooler receipt was carried out. The laboratory reported no quality control issues for the analytical procedures carried out on the sediment sampled in Astoria East Boat Basin for the May sampling event. The TBT result value that exceeded the SL was review to ensure that it met all QC criteria and the value is considered valid.

Methods for May 4, 1999 Sampling Event.

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. All of the 12 samples submitted for physical analyses exceeded 20% fines and were submitted for chemical analysis. Only 1 of the 12 samples exceeded 5% volatile solids. Samples were classified as silt to silty sand. Median grain size for the samples is 0.70mm, with an average of 45.5 % sand and 46.8 % fines.

Metals, Total Organic Carbon (TOC): Data for these analyses are presented in Table 2. Eleven samples were submitted for analyses. All inorganic metals were less than the SLs. The highest level detected was Zinc at 34% of the screening level.

Organotin (Total TBT): Data for these analyses are presented in Table 3. Note: Initially only the composite sample was run. When the analyses showed that TBT exceeded the SL, all samples were run for TBT to isolate area-containing TBT. In all, 13 samples were submitted for TBT analyses. The SL (0.15 ug/L) was exceeded in the composite sample for TBT (0.748 ug/L) further analyses of all individual samples collected indicated TBT above the SL to be located in the A-VC-03 (0.34 ug/L) sample. This sample is bracketed on the east by sample A-VC- 04 and on the west by sample A-VC-01, both of which are located outside the Phase II construction area.

Pesticide/PCBs: All data results for both pesticides and polychlorinated biphenyls PCBs were non-detect at the method detection limit (MDL) and practical quantitation limit (PQL). The non-detect is noted as part of Table 4. The PQLs are well below the screening levels adopted for evaluation of dredge material in the DMEF.

Phenols, Phthalates, Chlorinated Organic Compounds and Extractables: Data for these compounds are presented in Table 4. (Only compounds that were detected are listed). All compounds listed were detected at low levels. The highest level detected of all these compounds is only 8% of the DMEF screening level (SL).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs are presented in Tables 5 & 6. Both low and high density PAHs were detected at low levels in all of the samples submitted on May 4^{th,} but none approached the screening level (SL). The highest individual level of a PAH compound (acenaphthylene) detected was 64% of the SL. All other PAHs were less than 12% of the corresponding SL.

Conclusion

As mentioned in the text six vibra-core samples and 5 surface grab samples were collected on May 4, 1999. The samples were classified as silt to silty sand. The mean grain size of the samples was 0.70mm. All samples were submitted for Tier IIa (physical) and the Tier IIb (chemical) analyses, to include, 9 inorganic metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), and polynuclear aromatic hydrocarbons (PAHs). A composite from four sampling stations, A-VC-03 through A-VC-06, located inside the boat basin was analyzed for organotin (TBT) (interstitial pore water). Total TBT on the composite sample was 0.748ug/L. This value is in excess of the screening level (SL) of 0.15 ug/L stated in the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area. A follow-up TBT analyses on each of the sediment samples collected was conducted to determine where the high concentration TBT was. The individual TBT analyses indicated the TBT in excess of the SL to be located in sample A-VC-03. This sample is bracketed on each side by samples that are less than the SL and are outside the Phase II construction area. Further investigation of the area containing the TBT will be carried out in a future phase of construction. All other chemical analyses were below the screening levels. The sediment represented by the samples analyzed within the Phase II construction area is below DMEF screening levels and is acceptable for unconfined open water disposal.

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Table 1, Astoria East Boat Basin, Phase II **Sampled May 4, 1999**

Physical Analytical

	Grain Size (mm)				%					
Sample I.D.	**Median**		**Mean**		**Gravel**	**Sand**	**Silt/Clay**	**Volatile solids**		
A-VC-01A	0.043		0.0604		0.00	30.07	69.93		4.71	
A-VC-01B	0.055		0.0611		0.19	43.61	56.20		3.17	
A-VC –02A	0.085		0.1399		1.00	65.11	33.89		4.16	
A-VC –02B	0.43		1.8281		18.68	65.82	15.51		3.79	
A-VC -03	0.041		0.3850		5.33	29.81	64.86		3.80	
A-VC -04	0.042		0.0597		0.10	21.63	78.27		4.02	
A-VC -05	0.051		0.0592		0.00	32.73	67.27		2.33	
A-VC -06	0.050		0.0588		0.16	33.65	66.19		2.73	
A-PG-07	0.079		0.8085		9.50	44.99	45.50		5.09	
A-PG -08	0.32		0.8008		8.78	72.72	18.5		2.89	
A-PG -09	0.060		0.0648		0.00	53.62	46.38		4.37	
A-PG -10	0.14		1.0764		12.54	52.18	35.28		4.06	
A-PG -11	0.71		2.1153		25.02	42.34	32.65		4.32	
A-PG –11 (DUP)	2.0		2.3227		26.68	49.07	24.05		4.14	
Mean	0.293		0.7029		7.7129	45.52	46.75		3.83	
Minimum	0.041		0.0588		0.00	21.63	15.51		2.33	
Maximum	2.0		2.3227		26.68	72.72	69.93		5.09	

Table 2, Astoria East Boat Basin, Phase II **Sampled May 4, 1999**

Inorganic Metals and TOC

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg									mg/kg
A-VC-01A	3.6	<83	<.17	27	<14	<.13	11	<0.052	140	10000
A-VC-01B	5.4	<62	0.36	27	<10	<.12	11	<0.039	110	10000
A-VC -02	2.2	<86	<.18	17	<11	<.13	9.1	<0.054	77	10000
A-VC -03	6.2	<92	<.19	37	<15	<.15	13	<0.058	120	16000
A-VC -04	3.8	<69	0.21	26	<11	<.12	14	<0.043	110	16000
A-VC -05	2.2	<65	<.13	35	<11	<.10	5.2	<0.041	64	5300
A-VC -06	4.4	<71	<.15	21	<12	0.12	12	<0.044	100	5900
A-PG-07	3.3	<90	<.19	26	<15	<.12	9.7	<0.057	98	13000
A-PG -08	3.6	<67	<.14	13	<11	<.10	7.4	<0.042	51	8900
A-PG -09	2.5	<84	<.18	25	<14	<.10	13	<0.053	88	12000
A-PG -10	3.9	<74	<.15	21	<12	<.10	11	<0.046	82	10000
A-PG -11	15	<80	<.17	30	<13	<.12	15	<0.051	91	11000
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410	
Mean	4.7	ND	0.16	25.4	ND	ND	11	ND	94.3	
Maximum	15	ND	1.8	37	ND	ND	15	ND	140	

Symbol (<) = Non-detect at the value listed (Method Detection Limit)

Organotin

Sample ID		Tetrabutyltin	Tributyltin	Dibutyltin	Monobutyltin		Total TBT
			Ug/L (ppb)				
* Composite		**0.068**	**0.29**	**0.27**	**0.12**		**0.748**
A-VC-01A		<0.032	<0.024	<0.033	<0.03		ND
A-VC-01B		<0.047	<0.034	<0.048	<0.044		ND
A-VC -02		0.034	<0.024	<0.033	<0.03		0.034
A-VC -03		**0.086**	**0.25**	<0.053	<0.048		**0.336**
A-VC -04		<0.05	<0.036	<0.05	<0.046		ND
A-VC -05		<0.099	<0.072	<0.1	<0.092		ND
A-VC -06		<0.099	<0.072	<0.1	<0.092		ND
A-PG-07		<0.033	<0.024	<0.033	<0.031		ND
A-PG -08		<0.099	<0.072	<0.1	<0.092		ND
A-PG -09		<0.05	<0.036	<0.05	<0.046		ND
A-PG -10		<0.05	<0.036	<0.05	<0.046		ND
A-PG -11		<0.033	<0.024	<0.033	<0.031		ND
Screening level (SL)		+	+	+	+	=	0.15

TBT = Total organotin (interstitial water).

* This sample is a composite of sample A-VC-03 through A-VC-06.

Symbol (<) = Non-detect at the value listed (Method Detection Limit)

Note: Initially only the composite sample was run. When the analyses showed that TBT exceeded the SL, all samples were run for TBT to isolate area-containing TBT.

Pesticides/PCBs, Phenols, Phthalates, Chlorinated Organic Compounds and Extractables

Sample I.D.	Phenols			Phthalates					Extractables		
	ug/kg (ppb)										
	Phenol	Pentachlorophenol	3-&4-Methylphenol	Dimethylphthalate	bis(2-Ethylthexyl)phthalate	Butylbenzylphthalate	Diethylphthalate	Di-n-butylphthalate	Benzoic Acid	Benzyl Alcohol	Dibenzofuran
A-VC-01A	7.1	35	80	4.3	27	7.7	<14	12	<15	<14	<13
A-VC-01B	5.8	17	85	<13	38	<13	<14	9.7	<15	<14	6.9
A-VC -02	<12	<15	28	<13	<14	<13	5.3	14	<15	<14	4.4
A-VC -03	<12	51	46	<13	28	<13	8.9	5.9	<15	6.6	<14
A-VC -04	5.8	11	17	4.6	32	6.4	32	7.1	<15	<14	<14
A-VC -05	<12	<15	18	<13	18	<13	<14	7.7	<15	<14	<14
A-VC -06	<12	<15	<15	<13	11	<13	<14	6.2	<15	<14	<14
A-PG-07	23	27	53	3.1	35	5.5	<14	10	25	<14	<14
A-PG -08	<12	<15	17	<13	30	<13	<14	8.1	<15	<14	<14
A-PG -09	<12	<15	<15	<13	27	<13	<14	9.4	<15	<14	<14
A-PG -10	14	<15	220	3.1	19	<13	<14	7.9	<15	<14	<14
A-PG -11	34	<15	230	<13	18	<13	<14	<15	<15	<14	<14
Screening level (SL)	420	400	670	1400	8300	1200	970	8300	650	650	540
Mean	8	12	66	1.3	24	2	3.9	8	2	0.6	1
Maximum	34	51	230	4.6	38	7.7	32	14	25	6.6	6.9

PCBs = Non-detect <18.0 ppb (SL = 130 ppb)
Pesticides = Non-detect <0.33 to <2.4 ppb (SL = 10 ppb for all pesticides, except Total DDT = 6.9ppb
Symbol (<) = Non-detect at the value listed (Method Detection Limit)

Polynuclear Aromatic Hydrocarbons (PAHs)

Low Molecular Weight Analytes

ug/kg (ppb)

Sample I.D.	Acenapththene	Acenaphthylene	Anthracene	Fluorene	2-Methylnapthalene	Naphthalene	Phenanthrene	Total Low PAHs
A-VC-01A	<2.5	11	7.1	4.9	<2.8	6.2	27	56.2
A-VC-01B	<2.5	23	14	11	3.8	9.9	99	159.7
A-VC -02	8.1	360	66	30	4.4	5.6	28	502.1
A-VC -03	<3.1	13	10	7.2	16	5.3	46	97.5
A-VC -04	<3.1	5.8	6.1	2.5	<3.1	4.3	19	35.2
A-VC -05	<3.1	6.2	6.9	5.2	<2.4	8.7	39	66
A-VC -06	9.3	21	24	13	4.3	6.2	100	177.8
A-PG-07	<3.1	<3.1	4	<2.5	<3.1	<3.1	14	18
A-PG -08	<2.5	5.8	3.8	3.3	3.3	<2.5	64	80.2
A-PG -09	4.9	5.7	27	8.3	3.1	6.3	60	115.3
A-PG -10	<3.1	8.2	7.6	<2.5	<3.1	<3.1	27	42.8
A-PG -11	<3.1	<3.1	<2.9	<2.5	<3.1	<3.1	8	8
Screening level	500	560	960	540	670	2100	1500	5200
Mean	1.9	38.3	14.7	7.2	2.9	4.4	44.3	121.6
Maximum	9.3	360	66	30	16	9.9	100	502

Symbol (<) = Non-detect at the value listed (Method Detection Limit)

Polynuclear Aromatic Hydrocarbons (PAHs)

High Molecular Weight Analytes

ug/kg (ppb)

Sample I.D.	Benzo(a)anthracene	Benzo(b)fluroanthene	Benzo(k)fluroanthene	Benzo(g,h,i)perylene	Chrysene	Pyrene	Benzo(a)pyrene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Fluoranthene	Total High PAHs
A-VC-01A	24	56	11	39	32	65	36	<3.1	33	69	365
A-VC-01B	53	100	30	51	75	140	85	7.6	52	190	840
A-VC -02	160	64	20	23	170	260	130	<2.8	<2.8	120	947
A-VC -03	24	52	22	20	45	76	27	<3.3	28	130	424
A-VC -04	22	42	9	28	31	39	25	<2.5	23	41	260
A-VC -05	22	37	11	22	35	79	31	<2.5	23	88	346
A-VC -06	41	67	23	47	49	120	72	6	46	140	979
A-PG-07	11	25	4.9	13	15	29	11	<3.1	<3.1	19	128
A-PG -08	17	36	6	19	31	73	21	<2.5	14	48	255
A-PG -09	31	33	8	15	45	97	26	<2.9	20	68	343
A-PG -10	26	26	10	20	29	58	36	<2.8	15	44	264
A-PG -11	6.6	11	5.4	3.4	8	12	11	<2.9	6.6	13	77
Screening level	1300	3200		670	1400	2600	1600	230	600	1700	12000
Mean	36.5	30		25	47	87	43	1	22	81	436
Maximum	160	130		51	170	260	130	7.6	52	190	947

Symbol (<) = Non-detect at the value listed (Method Detection Limit)

Figure 1

Port of Astoria, East Boat Basin, Phase II